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| Ser Ile Asp Arg Asp Lys Asp Thr Leu Leu Ser Ser Ser Asn Arg Asn | | |
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| 80 | | |
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| 85 | 90 | 95 |
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| Leu Gln Leu Thr Asn Lys Asn Glu Gln Thr Thr Pro Glu Glu Glu | | |
| 100 | 105 | 110 |
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| Leu Lys Asn Pro Asp Arg Phe Val Leu Asp Leu Gln Gly Lys Trp Gly | | |
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Glu Glu Ala Lys Leu Val Leu Val Thr Asn Asn Glu Arg Leu Val Val
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Lys Pro Ile Ser Val Ala Ala Lys Phe Phe Glu Asn Tyr Arg Ser Phe
 450 455 460

Ala Glu Gly Glu Ile Gln Ala Leu Thr Trp Asp Gly Leu Gly Leu Gly
 465 470 475 480

Leu Val Trp Asn Thr Arg Arg Ile Lys Gly Thr Ile Thr Asp Phe Ala
 485 490 495

Leu Ala Asp Met Asn Asn Asp Gly Lys Leu Asp Leu Val Val Ser Val
 500 505 510

Asn Ser His Thr Gly Ile Leu Gly Leu Glu Lys Arg Lys Thr Ile Ile
 515 520 525

Val Phe Tyr Pro Leu Glu Val Asp Lys Gln Gly Ile Pro Lys Ala Val
 530 535 540

Glu Asp Asn
 545

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 <213> Lawsonia intracellularis

<220>
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 <222> (41)..(1522)

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 Met Val Ser Tyr Ile
 1 5

 cgt tta tta gga agt ata ttt tta gta tta gca att ttt ggt tgt ggc
 Arg Leu Leu Gly Ser Ile Phe Leu Val Leu Ala Ile Phe Gly Cys Gly 103

| 10 | 15 | 20 | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|-----|
| gct cag ttt aat aaa ccc tct tta ctt gat gaa acc cct ata gat tac Ala Gln Phe Asn Lys Pro Ser Leu Leu Asp Glu Thr Pro Ile Asp Tyr 25 30 35 | | | 151 |
| agt tct gta ctt tct gat tac ata gta gaa tta gaa aaa gaa cca ctt Ser Ser Val Leu Ser Asp Tyr Ile Val Glu Leu Glu Lys Glu Pro Leu 40 45 50 | | | 199 |
| cag tat ata tta cta aaa aaa gaa aaa ttt tct caa atg gag ata tat Gln Tyr Ile Leu Leu Lys Lys Glu Lys Phe Ser Gln Met Glu Ile Tyr 55 60 65 | | | 247 |
| aat tat caa ttc aca tca caa cat tgg tct cca gat aat ttt gta tca Asn Tyr Gln Phe Thr Ser Gln His Trp Ser Pro Asp Asn Phe Val Ser 70 75 80 85 | | | 295 |
| cct gct ata tgg gaa cat cag gta gat ata tat atc cct cac cat cca Pro Ala Ile Trp Glu His Gln Val Asp Ile Tyr Ile Pro His His Pro 90 95 100 | | | 343 |
| gtt tca gaa cgt gca ctt ctt atc atc aat aat ggt att aat aat ggt Val Ser Glu Arg Ala Leu Leu Ile Ile Asn Asn Gly Ile Asn Asn Gly 105 110 115 | | | 391 |
| aca ttt ttt act tct cct aaa gct cca act gat ttt act cca gaa gta Thr Phe Phe Thr Ser Pro Lys Ala Pro Thr Asp Phe Thr Pro Glu Val 120 125 130 | | | 439 |
| tta gaa gaa atc gct cgt tca aca aaa act gta gtc att gct cta agt Leu Glu Glu Ile Ala Arg Ser Thr Lys Thr Val Val Ile Ala Leu Ser 135 140 145 | | | 487 |
| gat atc cca aat cag tat ctt act tat aga ggt gac tgg aga ttt ctt Asp Ile Pro Asn Gln Tyr Leu Thr Tyr Arg Gly Asp Trp Arg Phe Leu 150 155 160 165 | | | 535 |
| aag gaa gat gaa agt att gct atg agt tgg tct agt ttt tta caa gat Lys Glu Asp Glu Ser Ile Ala Met Ser Trp Ser Ser Phe Leu Gln Asp 170 175 180 | | | 583 |
| cca gaa agt cgg tac aca aga cct ctc tat gtc cct atg gtt gca gca Pro Glu Ser Arg Tyr Thr Arg Pro Leu Tyr Val Pro Met Val Ala Ala 185 190 195 | | | 631 |
| gtt tct cag gca atg act ctt gca gaa aag gag tta caa gca tta aaa Val Ser Gln Ala Met Thr Leu Ala Glu Lys Glu Leu Gln Ala Leu Lys 200 205 210 | | | 679 |
| att aag cat ttt att gta tct ggt gtg tca aag cgt gga tgg aca aca Ile Lys His Phe Ile Val Ser Gly Val Ser Lys Arg Gly Trp Thr Thr 215 220 225 | | | 727 |
| tgg ctt tca gct att gct gac tca cga gta gat gct att acc ccg ttt Trp Leu Ser Ala Ile Ala Asp Ser Arg Val Asp Ala Ile Thr Pro Phe 230 235 240 245 | | | 775 |
| gtt att gat gca ttg aat act cgg aaa gtc ctt gga cat atg tat aaa Val Ile Asp Ala Leu Asn Thr Arg Lys Val Leu Gly His Met Tyr Lys 250 255 260 | | | 823 |
| aca tat gga aat aat tgg cct ata gca ttt tat cca tat tat aga ttt Thr Tyr Gly Asn Asn Trp Pro Ile Ala Phe Tyr Pro Tyr Tyr Arg Phe 265 270 275 | | | 871 |

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| gat tta gat aaa caa cta gat aca gtt cct ttt ttc aat ctt atg aat Asp Leu Asp Lys Gln Leu Asp Thr Val Pro Phe Phe Asn Leu Met Asn 280 285 290 | 919 |
| att gtt gat cca tat aga tat tta gga aca cca tat aag tct cga ctt Ile Val Asp Pro Tyr Arg Tyr Leu Gly Thr Pro Tyr Lys Ser Arg Leu 295 300 305 | 967 |
| gct atc cct aaa tat att gta aat gca agt gga gat gat ttt tat gtc Ala Ile Pro Lys Tyr Ile Val Asn Ala Ser Gly Asp Asp Phe Tyr Val 310 315 320 325 | 1015 |
| cct gat aat tca agt ttt tac tat gat gat ctc cct gga gag aaa gca Pro Asp Asn Ser Ser Phe Tyr Tyr Asp Asp Leu Pro Gly Glu Lys Ala 330 335 340 | 1063 |
| tta cgt ttt gca cca aac tca aat cat cat ggg ata tta aat ttc aca Leu Arg Phe Ala Pro Asn Ser Asn His His Gly Ile Leu Asn Phe Thr 345 350 355 | 1111 |
| aaa caa tcg ctt att cct ttt gtg aat aga gta caa aaa ggt att tca Lys Gln Ser Leu Ile Pro Phe Val Asn Arg Val Gln Lys Gly Ile Ser 360 365 370 | 1159 |
| acg cca gtt tta gat att tcc aca gag atg acg gaa cga gtt caa tat Thr Pro Val Leu Asp Ile Ser Thr Glu Met Thr Glu Arg Val Gln Tyr 375 380 385 | 1207 |
| gtg act gtt cgt ttt tct gaa gtt cca gag aag ata gta ctt tgg aaa Val Thr Val Arg Phe Ser Glu Val Pro Glu Lys Ile Val Leu Trp Lys 390 395 400 405 | 1255 |
| gca gca aat cca gag tca cga gat ttt cgt tat gcc tgt cgt gtt agg Ala Ala Asn Pro Glu Ser Arg Asp Phe Arg Tyr Ala Cys Arg Val Arg 410 415 420 | 1303 |
| tac atg gaa aca cca tta cac ctt tct gca aca ggg gaa gtt agc gtt Tyr Met Glu Thr Pro Leu His Leu Ser Ala Thr Gly Glu Val Ser Val 425 430 435 | 1351 |
| tca tta gag atc cct tct gta gga tgg caa gct gct ttt att gaa gct Ser Leu Glu Ile Pro Ser Val Gly Trp Gln Ala Ala Phe Ile Glu Ala 440 445 450 | 1399 |
| aca ttt aaa gat ggt ttt gtt gca aca aca cca gtg tat att tta cca Thr Phe Lys Asp Gly Phe Val Ala Thr Thr Pro Val Tyr Ile Leu Pro 455 460 465 | 1447 |
| aaa gat ata tat cca cct ata aaa ata cca cct gta cat gga tta tta Lys Asp Ile Tyr Pro Pro Ile Lys Ile Pro Pro Val His Gly Leu Leu 470 475 480 485 | 1495 |
| tgt aag ttt gta cat ggt cga acc tag taactagtag ttgttgtact Cys Lys Phe Val His Gly Arg Thr 490 | 1542 |
| gataatctaa aaggatata at | 1564 |

<210> 8
<211> 493
<212> PRT
<213> Lawsonia intracellularis

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Met Val Ser Tyr Ile Arg Leu Leu Gly Ser Ile Phe Leu Val Leu Ala
1 5 10 15

Ile Phe Gly Cys Gly Ala Gln Phe Asn Lys Pro Ser Leu Leu Asp Glu
20 25 30

Thr Pro Ile Asp Tyr Ser Ser Val Leu Ser Asp Tyr Ile Val Glu Leu
35 40 45

Glu Lys Glu Pro Leu Gln Tyr Ile Leu Leu Lys Lys Glu Lys Phe Ser
50 55 60

Gln Met Glu Ile Tyr Asn Tyr Gln Phe Thr Ser Gln His Trp Ser Pro
65 70 75 80

Asp Asn Phe Val Ser Pro Ala Ile Trp Glu His Gln Val Asp Ile Tyr
85 90 95

Ile Pro His His Pro Val Ser Glu Arg Ala Leu Leu Ile Ile Asn Asn
100 105 110

Gly Ile Asn Asn Gly Thr Phe Phe Thr Ser Pro Lys Ala Pro Thr Asp
115 120 125

Phe Thr Pro Glu Val Leu Glu Glu Ile Ala Arg Ser Thr Lys Thr Val
130 135 140

Val Ile Ala Leu Ser Asp Ile Pro Asn Gln Tyr Leu Thr Tyr Arg Gly
145 150 155 160

Asp Trp Arg Phe Leu Lys Glu Asp Glu Ser Ile Ala Met Ser Trp Ser
165 170 175

Ser Phe Leu Gln Asp Pro Glu Ser Arg Tyr Thr Arg Pro Leu Tyr Val
180 185 190

Pro Met Val Ala Ala Val Ser Gln Ala Met Thr Leu Ala Glu Lys Glu
195 200 205

Leu Gln Ala Leu Lys Ile Lys His Phe Ile Val Ser Gly Val Ser Lys
210 215 220

Arg Gly Trp Thr Thr Trp Leu Ser Ala Ile Ala Asp Ser Arg Val Asp
225 230 235 240

Ala Ile Thr Pro Phe Val Ile Asp Ala Leu Asn Thr Arg Lys Val Leu
245 250 255

Gly His Met Tyr Lys Thr Tyr Gly Asn Asn Trp Pro Ile Ala Phe Tyr
 260 265 270

Pro Tyr Tyr Arg Phe Asp Leu Asp Lys Gln Leu Asp Thr Val Pro Phe
 275 280 285

Phe Asn Leu Met Asn Ile Val Asp Pro Tyr Arg Tyr Leu Gly Thr Pro
 290 295 300

Tyr Lys Ser Arg Leu Ala Ile Pro Lys Tyr Ile Val Asn Ala Ser Gly
 305 310 315 320

Asp Asp Phe Tyr Val Pro Asp Asn Ser Ser Phe Tyr Tyr Asp Asp Leu
 325 330 335

Pro Gly Glu Lys Ala Leu Arg Phe Ala Pro Asn Ser Asn His His Gly
 340 345 350

Ile Leu Asn Phe Thr Lys Gln Ser Leu Ile Pro Phe Val Asn Arg Val
 355 360 365

Gln Lys Gly Ile Ser Thr Pro Val Leu Asp Ile Ser Thr Glu Met Thr
 370 375 380

Glu Arg Val Gln Tyr Val Thr Val Arg Phe Ser Glu Val Pro Glu Lys
 385 390 395 400

Ile Val Leu Trp Lys Ala Ala Asn Pro Glu Ser Arg Asp Phe Arg Tyr
 405 410 415

Ala Cys Arg Val Arg Tyr Met Glu Thr Pro Leu His Leu Ser Ala Thr
 420 425 430

Gly Glu Val Ser Val Ser Leu Glu Ile Pro Ser Val Gly Trp Gln Ala
 435 440 445

Ala Phe Ile Glu Ala Thr Phe Lys Asp Gly Phe Val Ala Thr Thr Pro
 450 455 460

Val Tyr Ile Leu Pro Lys Asp Ile Tyr Pro Pro Ile Lys Ile Pro Pro
 465 470 475 480

Val His Gly Leu Leu Cys Lys Phe Val His Gly Arg Thr
 485 490

<210> 9

<211> 2096

<212> DNA

<213> Lawsonia intracellularis

<220>
<221> CDS
<222> (12)..(2096)

| | |
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| <pre> <400> 9 aggacaaaac t atg gcg gat tat ctt tca gga gga att tct ttt gga gga Met Ala Asp Tyr Leu Ser Gly Gly Ile Ser Phe Gly Gly 1 5 10 att ggt agt gga acc gat ttc caa gct atg att gat caa ctt aag aaa Ile Gly Ser Gly Thr Asp Phe Gln Ala Met Ile Asp Gln Leu Lys Lys 15 20 25 att gag ctt att cct aaa aat aga ctt gta gtt tcc cat gaa caa tgg Ile Glu Leu Ile Pro Lys Asn Arg Leu Val Val Ser His Glu Gln Trp 30 35 40 45 aca aaa aaa tat aaa gca ttt gaa gag ctt ata aaa aca gtt aaa gat Thr Lys Lys Tyr Lys Ala Phe Glu Glu Leu Ile Lys Thr Val Lys Asp 50 55 60 act gaa gcg tct tta agt aag cta agt tct gtt ggt gct att tta aaa Thr Glu Ala Ser Leu Ser Lys Leu Ser Ser Val Gly Ala Ile Leu Lys 65 70 75 aaa gaa ggt tct gtt tca aat act tct gtt gca agc gtt aag gca agt Lys Glu Gly Ser Val Ser Asn Thr Ser Val Ala Ser Val Lys Ala Ser 80 85 90 tct gat gca tct gat gga aca cat aca att gat gtg aaa cag ctt gca Ser Asp Ala Ser Asp Gly Thr His Thr Ile Asp Val Lys Gln Leu Ala 95 100 105 aca aac acg att ctt tct aat aat cat att ttt gat tct aaa act gaa Thr Asn Thr Ile Leu Ser Asn Asn His Ile Phe Asp Ser Lys Thr Glu 110 115 120 125 agt att aat aat aca ggt tca cct ggt atc ttt gct tat gag tat aaa Ser Ile Asn Asn Thr Gly Ser Pro Gly Ile Phe Ala Tyr Glu Tyr Lys 130 135 140 ggg gaa cta cat gaa gtt gaa gtt cct cca ggt agt gat ctt gaa tat Gly Glu Leu His Glu Val Glu Val Pro Pro Gly Ser Asp Leu Glu Tyr 145 150 155 ctt gca aca tta ata aac aaa gat tct aat aat cct ggt gtt aaa gca Leu Ala Thr Leu Ile Asn Lys Asp Ser Asn Asn Pro Gly Val Lys Ala 160 165 170 aac ctt atc aag act ggc gat ggc tat atg ttt agt ctt gaa gga act Asn Leu Ile Lys Thr Gly Asp Gly Tyr Met Phe Ser Leu Glu Gly Thr 175 180 185 gaa act ggt gca aat gcg act tta tct att tca aat aag aca acg ctt Glu Thr Gly Ala Asn Ala Thr Leu Ser Ile Ser Asn Lys Thr Thr Leu 190 195 200 205 cca gac ttt aaa gca tct gtt gct acc agc agt gca tta gct aat ggt Pro Asp Phe Lys Ala Ser Val Ala Thr Ser Ser Ala Leu Ala Asn Gly 210 215 220 gaa gat aca att att aat act tca gga aca act caa caa ttt tct ttt Glu Asp Thr Ile Ile Asn Thr Ser Gly Thr Thr Gln Gln Phe Ser Phe 222 </pre> | 50 98 146 194 242 290 338 386 434 482 530 578 626 674 722 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|

| 225 | 230 | 235 | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|------|
| gaa tac aat gga aga aca ttt act ttc gat att cct tca gga aca aca Glu Tyr Asn Gly Arg Thr Phe Thr Phe Asp Ile Pro Ser Gly Thr Thr 240 245 250 | | | 770 |
| gca aaa gaa ctc caa aca gct ata aat gaa aat aca aaa aat aca gga Ala Lys Glu Leu Gln Thr Ala Ile Asn Glu Asn Thr Lys Asn Thr Gly 255 260 265 | | | 818 |
| gta cgt gca act ttt gaa aaa cat ggc tca gat ata gta ttg caa tta Val Arg Ala Thr Phe Glu Lys His Gly Ser Asp Ile Val Leu Gln Leu 270 275 280 285 | | | 866 |
| gaa gga aca gtt cct aat caa caa gtt aaa gta acc gct agc cct act Glu Gly Thr Val Pro Asn Gln Gln Val Lys Val Thr Ala Ser Pro Thr 290 295 300 | | | 914 |
| gat ctt gga agt ttc aca tct tcg ggt caa gca ggc tgg aat aaa cgt Asp Leu Gly Ser Phe Thr Ser Ser Gly Gln Ala Gly Trp Asn Lys Arg 305 310 315 | | | 962 |
| gat tct caa gat gct att ttt aat att aat ggt tgg gac caa gaa ctt Asp Ser Gln Asp Ala Ile Phe Asn Ile Asn Gly Trp Asp Gln Glu Leu 320 325 330 | | | 1010 |
| aca tct tct aca aat gaa ctt aca gaa gtt atc cca gga ctt caa att Thr Ser Ser Thr Asn Glu Leu Thr Glu Val Ile Pro Gly Leu Gln Ile 335 340 345 | | | 1058 |
| aca cta ctt tcc gaa ggg aaa aca caa att aca att cag act tct act Thr Leu Leu Ser Glu Gly Lys Thr Gln Ile Thr Ile Gln Thr Ser Thr 350 355 360 365 | | | 1106 |
| gac gaa gta aaa aaa caa gtt gag aaa gca gta gag tct ata aat aat Asp Glu Val Lys Lys Gln Val Glu Lys Ala Val Glu Ser Ile Asn Asn 370 375 380 | | | 1154 |
| gtt ctt tcc aaa att caa gag tta act aaa gca aca gct gaa gac aaa Val Leu Ser Lys Ile Gln Glu Leu Thr Lys Ala Thr Ala Glu Asp Lys 385 390 395 | | | 1202 |
| gat gat agt aaa gac act tct agt tct tca agt aaa att cca tca tat Asp Asp Ser Lys Asp Thr Ser Ser Ser Ser Lys Ile Pro Ser Tyr 400 405 410 | | | 1250 |
| tta caa agt cct aca aaa gtg aag gct gga cta ttt aca ggt gat act Leu Gln Ser Pro Thr Lys Val Lys Ala Gly Leu Phe Thr Gly Asp Thr 415 420 425 | | | 1298 |
| ggc ata caa atg ctt agt act aga ctt aag tct atc ttt tct tct aat Gly Ile Gln Met Leu Ser Thr Arg Leu Lys Ser Ile Phe Ser Ser Asn 430 435 440 445 | | | 1346 |
| ggt cta ggt ttt tct cct aaa caa aca caa gat ggt cca ggg gat cta Gly Leu Gly Phe Ser Pro Lys Gln Thr Gln Asp Gly Pro Gly Asp Leu 450 455 460 | | | 1394 |
| ttt tca tca ctt gct tca att ggt att gtc gta gat gct gat gag ggt Phe Ser Ser Leu Ala Ser Ile Gly Ile Val Val Asp Ala Asp Glu Gly 465 470 475 | | | 1442 |
| agt gaa act ttt gga caa ctt aaa att tta gat aga gaa aca att ggt Ser Glu Thr Phe Gly Gln Leu Lys Ile Leu Asp Arg Glu Thr Ile Gly 480 485 490 | | | 1490 |

| | |
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| cct gat gca cct tat aca act ctt gat gag gca tta aaa aaa gat cca Pro Asp Ala Pro Tyr Thr Thr Leu Asp Glu Ala Leu Lys Lys Asp Pro 495 500 505 | 1538 |
| caa gca gta gca gat ata tta gct ggt agt tct gga ata tct gat tca Gln Ala Val Ala Asp Ile Leu Ala Gly Ser Ser Gly Ile Ser Asp Ser 510 515 520 525 | 1586 |
| aca gat ttt tct tat caa gat cat att gtt gga aaa aca caa gct ggt Thr Asp Phe Ser Tyr Gln Asp His Ile Val Gly Lys Thr Gln Ala Gly 530 535 540 | 1634 |
| aca tat gat gta aag tat tct gta gat gca agt ggt act ata gga gac Thr Tyr Asp Val Lys Tyr Ser Val Asp Ala Ser Gly Thr Ile Gly Asp 545 550 555 | 1682 |
| gtt tac att gga ggt gta aaa gct tct cta tct gat cct gca aaa aat Val Tyr Ile Gly Gly Val Lys Ala Ser Leu Ser Asp Pro Ala Lys Asn 560 565 570 | 1730 |
| ata tat acg gtc aca tct ggt cct gct aca ggt ctt agt ata gca gtt Ile Tyr Thr Val Thr Ser Gly Pro Ala Thr Gly Leu Ser Ile Ala Val 575 580 585 | 1778 |
| aat aat cgt act cca ggt atc aat gta gaa agt act gta aga gtc aaa Asn Asn Arg Thr Pro Gly Ile Asn Val Glu Ser Thr Val Arg Val Lys 590 595 600 605 | 1826 |
| caa ggt aaa ctt agc caa ata caa gaa gca ctt aaa gct gaa gta cag Gln Gly Lys Leu Ser Gln Ile Gln Glu Ala Leu Lys Ala Glu Val Gln 610 615 620 | 1874 |
| caa gat cct tta aaa gaa aac aca ggt cct tta att atc atg caa gat Gln Asp Pro Leu Lys Glu Asn Thr Gly Pro Leu Ile Ile Met Gln Asp 625 630 635 | 1922 |
| aac tat aag gat gtt atg aaa aat ctt gag aca aga ata gaa aaa gaa Asn Tyr Lys Asp Val Met Lys Asn Leu Glu Thr Arg Ile Glu Lys Glu 640 645 650 | 1970 |
| aca caa aga gtt act agt tgg gaa cgt atg atg cgt tta aaa ttt tct Thr Gln Arg Val Thr Ser Trp Glu Arg Met Met Arg Leu Lys Phe Ser 655 660 665 | 2018 |
| aga ctt gat gct gta tta gca aaa tat aat cag atg atg tca gca aat Arg Leu Asp Ala Val Leu Ala Lys Tyr Asn Gln Met Met Ser Ala Asn 670 675 680 685 | 2066 |
| gct tct agt tta ggg caa ctt ggt gca taa Ala Ser Ser Leu Gly Gln Leu Gly Ala 690 | 2096 |
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| <210> 10 | |
| <211> 694 | |
| <212> PRT | |
| <213> Lawsonia intracellularis | |
| | |
| <400> 10 | |
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Gly Thr Asp Phe Gln Ala Met Ile Asp Gln Leu Lys Lys Ile Glu Leu
 20 25 30

Ile Pro Lys Asn Arg Leu Val Val Ser His Glu Gln Trp Thr Lys Lys
 35 40 45

Tyr Lys Ala Phe Glu Glu Leu Ile Lys Thr Val Lys Asp Thr Glu Ala
 50 55 60

Ser Leu Ser Lys Leu Ser Ser Val Gly Ala Ile Leu Lys Lys Glu Gly
 65 70 75 80

Ser Val Ser Asn Thr Ser Val Ala Ser Val Lys Ala Ser Ser Asp Ala
 85 90 95

Ser Asp Gly Thr His Thr Ile Asp Val Lys Gln Leu Ala Thr Asn Thr
 100 105 110

Ile Leu Ser Asn Asn His Ile Phe Asp Ser Lys Thr Glu Ser Ile Asn
 115 120 125

Asn Thr Gly Ser Pro Gly Ile Phe Ala Tyr Glu Tyr Lys Gly Glu Leu
 130 135 140

His Glu Val Glu Val Pro Pro Gly Ser Asp Leu Glu Tyr Leu Ala Thr
 145 150 155 160

Leu Ile Asn Lys Asp Ser Asn Asn Pro Gly Val Lys Ala Asn Leu Ile
 165 170 175

Lys Thr Gly Asp Gly Tyr Met Phe Ser Leu Glu Gly Thr Glu Thr Gly
 180 185 190

Ala Asn Ala Thr Leu Ser Ile Ser Asn Lys Thr Thr Leu Pro Asp Phe
 195 200 205

Lys Ala Ser Val Ala Thr Ser Ser Ala Leu Ala Asn Gly Glu Asp Thr
 210 215 220

Ile Ile Asn Thr Ser Gly Thr Thr Gln Gln Phe Ser Phe Glu Tyr Asn
 225 230 235 240

Gly Arg Thr Phe Thr Phe Asp Ile Pro Ser Gly Thr Thr Ala Lys Glu
 245 250 255

Leu Gln Thr Ala Ile Asn Glu Asn Thr Lys Asn Thr Gly Val Arg Ala
 260 265 270

Thr Phe Glu Lys His Gly Ser Asp Ile Val Leu Gln Leu Glu Gly Thr

| | | |
|-----------------------------------------------------------------|-----|-----|
| 275 | 280 | 285 |
| Val Pro Asn Gln Gln Val Lys Val Thr Ala Ser Pro Thr Asp Leu Gly | | |
| 290 | 295 | 300 |
| Ser Phe Thr Ser Ser Gly Gln Ala Gly Trp Asn Lys Arg Asp Ser Gln | | |
| 305 | 310 | 315 |
| Asp Ala Ile Phe Asn Ile Asn Gly Trp Asp Gln Glu Leu Thr Ser Ser | | |
| 325 | 330 | 335 |
| Thr Asn Glu Leu Thr Glu Val Ile Pro Gly Leu Gln Ile Thr Leu Leu | | |
| 340 | 345 | 350 |
| Ser Glu Gly Lys Thr Gln Ile Thr Ile Gln Thr Ser Thr Asp Glu Val | | |
| 355 | 360 | 365 |
| Lys Lys Gln Val Glu Lys Ala Val Glu Ser Ile Asn Asn Val Leu Ser | | |
| 370 | 375 | 380 |
| Lys Ile Gln Glu Leu Thr Lys Ala Thr Ala Glu Asp Lys Asp Asp Ser | | |
| 385 | 390 | 395 |
| 400 | | |
| Lys Asp Thr Ser Ser Ser Ser Lys Ile Pro Ser Tyr Leu Gln Ser | | |
| 405 | 410 | 415 |
| Pro Thr Lys Val Lys Ala Gly Leu Phe Thr Gly Asp Thr Gly Ile Gln | | |
| 420 | 425 | 430 |
| Met Leu Ser Thr Arg Leu Lys Ser Ile Phe Ser Ser Asn Gly Leu Gly | | |
| 435 | 440 | 445 |
| Phe Ser Pro Lys Gln Thr Gln Asp Gly Pro Gly Asp Leu Phe Ser Ser | | |
| 450 | 455 | 460 |
| Leu Ala Ser Ile Gly Ile Val Val Asp Ala Asp Glu Gly Ser Glu Thr | | |
| 465 | 470 | 475 |
| 480 | | |
| Phe Gly Gln Leu Lys Ile Leu Asp Arg Glu Thr Ile Gly Pro Asp Ala | | |
| 485 | 490 | 495 |
| Pro Tyr Thr Thr Leu Asp Glu Ala Leu Lys Lys Asp Pro Gln Ala Val | | |
| 500 | 505 | 510 |
| Ala Asp Ile Leu Ala Gly Ser Ser Gly Ile Ser Asp Ser Thr Asp Phe | | |
| 515 | 520 | 525 |
| Ser Tyr Gln Asp His Ile Val Gly Lys Thr Gln Ala Gly Thr Tyr Asp | | |
| 530 | 535 | 540 |

Val Lys Tyr Ser Val Asp Ala Ser Gly Thr Ile Gly Asp Val Tyr Ile
 545 550 555 560

Gly Gly Val Lys Ala Ser Leu Ser Asp Pro Ala Lys Asn Ile Tyr Thr
 565 570 575

Val Thr Ser Gly Pro Ala Thr Gly Leu Ser Ile Ala Val Asn Asn Arg
 580 585 590

Thr Pro Gly Ile Asn Val Glu Ser Thr Val Arg Val Lys Gln Gly Lys
 595 600 605

Leu Ser Gln Ile Gln Glu Ala Leu Lys Ala Glu Val Gln Gln Asp Pro
 610 615 620

Leu Lys Glu Asn Thr Gly Pro Leu Ile Ile Met Gln Asp Asn Tyr Lys
 625 630 635 640

Asp Val Met Lys Asn Leu Glu Thr Arg Ile Glu Lys Glu Thr Gln Arg
 645 650 655

Val Thr Ser Trp Glu Arg Met Met Arg Leu Lys Phe Ser Arg Leu Asp
 660 665 670

Ala Val Leu Ala Lys Tyr Asn Gln Met Met Ser Ala Asn Ala Ser Ser
 675 680 685

Leu Gly Gln Leu Gly Ala
 690

<210> 11
 <211> 1200
 <212> DNA
 <213> Lawsonia intracellularis

<220>
 <221> CDS
 <222> (13)..(1200)

<400> 11
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 Met Ala Asn Val Ser Gly Ile Pro Ala Pro Arg Leu Leu
 1 5 10

tcc aca aca aat caa atg acc aat gca gct gct aat act aat aga 99
 Ser Thr Thr Asn Gln Met Thr Asn Ala Ala Gly Asn Thr Asn Arg
 15 20 25

gct acc ggt agt atg aac ggt cgt aat ctc aca caa ata aaa aca cct 147
 Ala Thr Gly Ser Met Asn Gly Arg Asn Leu Thr Gln Ile Lys Thr Pro
 30 35 40 45

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| cag tcc atg att gat aat gct tca gaa gaa tta aca act tct ctt gaa Gln Ser Met Ile Asp Asn Ala Ser Glu Glu Leu Thr Thr Ser Leu Glu 50 55 60 | 195 |
| tct aaa agc agt gac gac ttt gca att aaa gat cgt aaa aga caa ggg Ser Lys Ser Ser Asp Asp Phe Ala Ile Lys Asp Arg Lys Arg Gln Gly 65 70 75 | 243 |
| aaa gga tct gat tct cta tta aaa atg gtt caa gaa tat aca gag ctg Lys Gly Ser Asp Ser Leu Leu Lys Met Val Gln Glu Tyr Thr Glu Leu 80 85 90 | 291 |
| acg aat gat gat acc cgt aat gct aaa aga gct atg tta tcc cag gta Thr Asn Asp Asp Thr Arg Asn Ala Lys Arg Ala Met Leu Ser Gln Val 95 100 105 | 339 |
| tta cgt gca agt caa agt tca caa gat gta ctc gaa aaa aca tta gaa Leu Arg Ala Ser Gln Ser Ser Gln Asp Val Leu Glu Lys Thr Leu Glu 110 115 120 125 | 387 |
| caa ttt tct aat aaa aca gat gct tgg gct tct ctt gca gaa att gca Gln Phe Ser Asn Lys Thr Asp Ala Trp Ala Ser Leu Ala Glu Ile Ala 130 135 140 | 435 |
| caa gaa tat ggt gca gaa tct cca cag cca aca gga tta aaa tct gta Gln Glu Tyr Gly Ala Glu Ser Pro Gln Pro Thr Gly Leu Lys Ser Val 145 150 155 | 483 |
| tta gat gct atg gag aca tta gaa aat gag ttt ggt gat gaa att aaa Leu Asp Ala Met Glu Thr Leu Glu Asn Glu Phe Gly Asp Glu Ile Lys 160 165 170 | 531 |
| gca gga cta aaa gga gct cta aat tca aaa gaa ttt act gat ata ggc Ala Gly Leu Lys Gly Ala Leu Asn Ser Lys Glu Phe Thr Asp Ile Gly 175 180 185 | 579 |
| agt gca gca cag tta aga gat ctt tat aca aca aca gta act ata aca Ser Ala Ala Gln Leu Arg Asp Leu Tyr Thr Thr Val Thr Ile Thr 190 195 200 205 | 627 |
| gct gca cct gat gca gtg tta gca aga ctt ctt gaa gaa tat gag agt Ala Ala Pro Asp Ala Val Leu Ala Arg Leu Leu Glu Glu Tyr Glu Ser 210 215 220 | 675 |
| gat gat gat ctg gat aga gcc att gat ttc ctt cta tct aca ctt ggt Asp Asp Asp Leu Asp Arg Ala Ile Asp Phe Leu Leu Ser Thr Leu Gly 225 230 235 | 723 |
| gga gag ctt gaa tca gct gat cca agt atg gat aaa gta cat ctt caa Gly Glu Leu Glu Ser Ala Asp Pro Ser Met Asp Lys Val His Leu Gln 240 245 250 | 771 |
| agt gta atg ggt gat att gaa aaa aca caa caa ctt cat agc tct cat Ser Val Met Gly Asp Ile Glu Lys Thr Gln Gln Leu His Ser Ser His 255 260 265 | 819 |
| aaa caa tgt act aca gcc ctt agc agg tgg aaa gag aaa cat aaa ggt Lys Gln Cys Thr Thr Ala Leu Ser Arg Trp Lys Glu Lys His Lys Gly 270 275 280 285 | 867 |
| ggg ggg gaa aat agt aca cta act cct tta gaa atg atg cgt gaa cta Gly Gly Glu Asn Ser Thr Leu Thr Pro Leu Glu Met Met Arg Glu Leu 290 295 300 | 915 |
| att gca cta aaa aat gaa aat ttt att tct cct tcc tct ata gat aaa | 963 |

| | | | |
|-----------------------------------------------------------------|-----|-----|------|
| Ile Ala Leu Lys Asn Glu Asn Phe Ile Ser Pro Ser Ser Ile Asp Lys | | | |
| 305 | 310 | 315 | |
| att gtt gat caa gct gat ccc caa gat att gaa aaa gaa gtc ctt ttt | | | 1011 |
| Ile Val Asp Gln Ala Asp Pro Gln Asp Ile Glu Lys Glu Val Leu Phe | | | |
| 320 | 325 | 330 | |
| tta caa gag atg tta gct gct gta aga aaa ttt ccc att atg gta ttt | | | 1059 |
| Leu Gln Glu Met Leu Ala Ala Val Arg Lys Phe Pro Ile Met Val Phe | | | |
| 335 | 340 | 345 | |
| gat aat gtc gaa aat cgt gta aga gtt atg ggt gct gta caa gat gct | | | 1107 |
| Asp Asn Val Glu Asn Arg Val Arg Val Met Gly Ala Val Gln Asp Ala | | | |
| 350 | 355 | 360 | 365 |
| gtt gac gat gct gta aga aga gaa ttc ctc ttt caa aaa gaa | | | 1155 |
| Val Asp Asp Ala Val Arg Arg Glu Asp Glu Phe Leu Phe Gln Lys Glu | | | |
| 370 | 375 | 380 | |
| cat cct gat gta cca cta caa cca gat gaa aat aat ata caa taa | | | 1200 |
| His Pro Asp Val Pro Leu Gln Pro Asp Glu Asn Asn Ile Gln | | | |
| 385 | 390 | 395 | |
| <210> 12 | | | |
| <211> 395 | | | |
| <212> PRT | | | |
| <213> Lawsonia intracellularis | | | |
| <400> 12 | | | |
| Met Ala Asn Val Ser Gly Ile Pro Ala Pro Arg Leu Leu Ser Thr Thr | | | |
| 1 | 5 | 10 | 15 |
| Asn Gln Met Thr Asn Ala Ala Gly Asn Thr Asn Arg Ala Thr Gly | | | |
| 20 | 25 | 30 | |
| Ser Met Asn Gly Arg Asn Leu Thr Gln Ile Lys Thr Pro Gln Ser Met | | | |
| 35 | 40 | 45 | |
| Ile Asp Asn Ala Ser Glu Glu Leu Thr Thr Ser Leu Glu Ser Lys Ser | | | |
| 50 | 55 | 60 | |
| Ser Asp Asp Phe Ala Ile Lys Asp Arg Lys Arg Gln Gly Lys Gly Ser | | | |
| 65 | 70 | 75 | 80 |
| Asp Ser Leu Leu Lys Met Val Gln Glu Tyr Thr Glu Leu Thr Asn Asp | | | |
| 85 | 90 | 95 | |
| Asp Thr Arg Asn Ala Lys Arg Ala Met Leu Ser Gln Val Leu Arg Ala | | | |
| 100 | 105 | 110 | |
| Ser Gln Ser Ser Gln Asp Val Leu Glu Lys Thr Leu Glu Gln Phe Ser | | | |
| 115 | 120 | 125 | |
| Asn Lys Thr Asp Ala Trp Ala Ser Leu Ala Glu Ile Ala Gln Glu Tyr | | | |
| 130 | 135 | 140 | |

Gly Ala Glu Ser Pro Gln Pro Thr Gly Leu Lys Ser Val Leu Asp Ala
 145 150 155 160

Met Glu Thr Leu Glu Asn Glu Phe Gly Asp Glu Ile Lys Ala Gly Leu
 165 170 175

Lys Gly Ala Leu Asn Ser Lys Glu Phe Thr Asp Ile Gly Ser Ala Ala
 180 185 190

Gln Leu Arg Asp Leu Tyr Thr Thr Val Thr Ile Thr Ala Ala Pro
 195 200 205

Asp Ala Val Leu Ala Arg Leu Leu Glu Glu Tyr Glu Ser Asp Asp Asp
 210 215 220

Leu Asp Arg Ala Ile Asp Phe Leu Leu Ser Thr Leu Gly Gly Glu Leu
 225 230 235 240

Glu Ser Ala Asp Pro Ser Met Asp Lys Val His Leu Gln Ser Val Met
 245 250 255

Gly Asp Ile Glu Lys Thr Gln Gln Leu His Ser Ser His Lys Gln Cys
 260 265 270

Thr Thr Ala Leu Ser Arg Trp Lys Glu Lys His Lys Gly Gly Glu
 275 280 285

Asn Ser Thr Leu Thr Pro Leu Glu Met Met Arg Glu Leu Ile Ala Leu
 290 295 300

Lys Asn Glu Asn Phe Ile Ser Pro Ser Ser Ile Asp Lys Ile Val Asp
 305 310 315 320

Gln Ala Asp Pro Gln Asp Ile Glu Lys Glu Val Leu Phe Leu Gln Glu
 325 330 335

Met Leu Ala Ala Val Arg Lys Phe Pro Ile Met Val Phe Asp Asn Val
 340 345 350

Glu Asn Arg Val Arg Val Met Gly Ala Val Gln Asp Ala Val Asp Asp
 355 360 365

Ala Val Arg Arg Glu Asp Glu Phe Leu Phe Gln Lys Glu His Pro Asp
 370 375 380

Val Pro Leu Gln Pro Asp Glu Asn Asn Ile Gln
 385 390 395

<210> 13
<211> 1269
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<213> Lawsonia intracellularis

<220>
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<222> (32)..(1222)

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| <pre> <400> 13 tgtggaaat tctctctgga ggagtaaagc a atg aca aat ttt gga gat ata Met Thr Asn Phe Gly Asp Ile 1 5 agc gga agc tcc gca aga atg agt agc ttg atg act ggt aca tcc ggt Ser Gly Ser Ser Ala Arg Met Ser Ser Leu Met Thr Gly Thr Ser Gly 10 15 20 gaa gaa gga ctt gaa gaa ctt gaa ggt ggt gtt cct aaa gag caa ggt Glu Glu Gly Leu Glu Glu Leu Glu Gly Gly Val Pro Lys Glu Gln Gly 25 30 35 ggt cca ggt aaa gga gat gct tca gag gct gct aaa ggt caa gca gca Gly Pro Gly Lys Gly Asp Ala Ser Glu Ala Ala Lys Gly Gln Ala Ala 40 45 50 55 gca gat agt att aat tca gct ggt ggt act gaa aag cct gga gaa gtt Ala Asp Ser Ile Asn Ser Ala Gly Gly Thr Glu Lys Pro Gly Glu Val 60 65 70 ggt gat aag gaa gat gta ggg gaa ggt ggc gaa ata cct gaa ggt ggt Gly Asp Lys Glu Asp Val Gly Glu Gly Glu Ile Pro Glu Gly Gly 75 80 85 gaa ata cct gag ggt ggt gaa gaa gtt cca gag gaa ccc cca tat gtc Glu Ile Pro Glu Gly Glu Val Pro Glu Glu Pro Pro Tyr Val 90 95 100 cct cct cca ttg gtt gaa cca gct aaa atc agt aca gta aca gat ctc Pro Pro Pro Leu Val Glu Pro Ala Lys Ile Ser Thr Val Thr Asp Leu 105 110 115 agt acg tta atg gga tca cta cag ctg aca gag caa aaa aag aat gct Ser Thr Leu Met Gly Ser Leu Gln Leu Thr Glu Gln Lys Lys Asn Ala 120 125 130 135 gaa aaa aca gta aat gaa att aaa gca cag aat aaa gag caa caa gta Glu Lys Thr Val Asn Glu Ile Lys Ala Gln Asn Lys Glu Gln Gln Val 140 145 150 aag ttc caa gag caa att aaa aag att gag gat aat att gct gaa tct Lys Phe Gln Glu Gln Ile Lys Ile Glu Asp Asn Ile Ala Glu Ser 155 160 165 aag aaa agt ggt ata ctt aag ttt ttc caa aag ttg ttt gca gtt att Lys Lys Ser Gly Ile Leu Lys Phe Phe Gln Lys Leu Phe Ala Val Ile 170 175 180 ggt gct gta cta gga gct att gga ggt gcg cta gct att gct gca ggt Gly Ala Val Leu Gly Ala Ile Gly Gly Ala Leu Ala Ile Ala Ala Gly 185 190 195 gct gct tca ggt aac cca tta ttg gtt gct gca ggt att atg gct att </pre> | 52 100 148 196 244 292 340 388 436 484 532 580 628 676 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|

| | | | |
|-----------------------------------------------------------------|-----|-----|------|
| Ala Ala Ser Gly Asn Pro Leu Leu Val Ala Ala Gly Ile Met Ala Ile | | | |
| 200 | 205 | 210 | 215 |
| gta gct tca att gat gca gca atg tcg tcg cta tcg gat ggt aaa gtg | | | 724 |
| Val Ala Ser Ile Asp Ala Ala Met Ser Ser Leu Ser Asp Gly Lys Val | | | |
| 220 | 225 | 230 | |
| tcc atc tca gca ggg att agt aag gct ctt gag gct atg gga gta cca | | | 772 |
| Ser Ile Ser Ala Gly Ile Ser Lys Ala Leu Glu Ala Met Gly Val Pro | | | |
| 235 | 240 | 245 | |
| gca gaa aca gca caa tgg att gca ttt ggt ata cag tta gca atg att | | | 820 |
| Ala Glu Thr Ala Gln Trp Ile Ala Phe Gly Ile Gln Leu Ala Met Ile | | | |
| 250 | 255 | 260 | |
| gca gtg act ata gct att ggt ttt gcc tct ggt ggt gga gca atg | | | 868 |
| Ala Val Thr Ile Ala Ile Gly Phe Ala Ser Gly Gly Gly Ala Met | | | |
| 265 | 270 | 275 | |
| gct gga gtg tca aaa ata gca gat atg ttt tca aag tct caa gat gta | | | 916 |
| Ala Gly Val Ser Lys Ile Ala Asp Met Phe Ser Lys Ser Gln Asp Val | | | |
| 280 | 285 | 290 | 295 |
| gct aag ttg gca cag atg att gaa aaa gct tct aaa ata gta caa atc | | | 964 |
| Ala Lys Leu Ala Gln Met Ile Glu Lys Ala Ser Lys Ile Val Gln Ile | | | |
| 300 | 305 | 310 | |
| gct ggt tca gtt aat cag tct gct ata ggc ggt aca ggt att ggt aca | | | 1012 |
| Ala Gly Ser Val Asn Gln Ser Ala Ile Gly Gly Thr Gly Ile Gly Thr | | | |
| 315 | 320 | 325 | |
| gct gta gtg caa agc aat ata aaa gct aat gaa tct gaa caa aaa gaa | | | 1060 |
| Ala Val Val Gln Ser Asn Ile Lys Ala Asn Glu Ser Glu Gln Lys Glu | | | |
| 330 | 335 | 340 | |
| att gaa gct gct att gca aaa gtt aaa gct aag ata gag acg tta caa | | | 1108 |
| Ile Glu Ala Ala Ile Ala Lys Val Lys Ala Lys Ile Glu Thr Leu Gln | | | |
| 345 | 350 | 355 | |
| gac ttc ttt aaa aac caa atg gaa caa ttc aat gct ata atg aaa ata | | | 1156 |
| Asp Phe Phe Lys Asn Gln Met Glu Gln Phe Asn Ala Ile Met Lys Ile | | | |
| 360 | 365 | 370 | 375 |
| ata aca gat att att caa gat agc gtc aat aca aaa ata gct gtt caa | | | 1204 |
| Ile Thr Asp Ile Ile Gln Asp Ser Val Asn Thr Lys Ile Ala Val Gln | | | |
| 380 | 385 | 390 | |
| cgt ggt gca cgt gag taa taccttagt aaatacagtg actatactat | | | 1252 |
| Arg Gly Ala Arg Glu | | | |
| 395 | | | |
| aatatataaa ttaataa | | | 1269 |
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| <211> 396 | | | |
| <212> PRT | | | |
| <213> Lawsonia intracellularis | | | |
| <400> 14 | | | |
| Met Thr Asn Phe Gly Asp Ile Ser Gly Ser Ser Ala Arg Met Ser Ser | | | |
| 1 | 5 | 10 | 15 |

Leu Met Thr Gly Thr Ser Gly Glu Glu Gly Leu Glu Glu Leu Glu Gly
 20 25 30

Gly Val Pro Lys Glu Gln Gly Gly Pro Gly Lys Gly Asp Ala Ser Glu
 35 40 45

Ala Ala Lys Gly Gln Ala Ala Ala Asp Ser Ile Asn Ser Ala Gly Gly
 50 55 60

Thr Glu Lys Pro Gly Glu Val Gly Asp Lys Glu Asp Val Gly Glu Gly
 65 70 75 80

Gly Glu Ile Pro Glu Gly Gly Glu Ile Pro Glu Gly Gly Glu Glu Val
 85 90 95

Pro Glu Glu Pro Pro Tyr Val Pro Pro Pro Leu Val Glu Pro Ala Lys
 100 105 110

Ile Ser Thr Val Thr Asp Leu Ser Thr Leu Met Gly Ser Leu Gln Leu
 115 120 125

Thr Glu Gln Lys Lys Asn Ala Glu Lys Thr Val Asn Glu Ile Lys Ala
 130 135 140

Gln Asn Lys Glu Gln Gln Val Lys Phe Gln Glu Gln Ile Lys Lys Ile
 145 150 155 160

Glu Asp Asn Ile Ala Glu Ser Lys Lys Ser Gly Ile Leu Lys Phe Phe
 165 170 175

Gln Lys Leu Phe Ala Val Ile Gly Ala Val Leu Gly Ala Ile Gly Gly
 180 185 190

Ala Leu Ala Ile Ala Ala Gly Ala Ala Ser Gly Asn Pro Leu Leu Val
 195 200 205

Ala Ala Gly Ile Met Ala Ile Val Ala Ser Ile Asp Ala Ala Met Ser
 210 215 220

Ser Leu Ser Asp Gly Lys Val Ser Ile Ser Ala Gly Ile Ser Lys Ala
 225 230 235 240

Leu Glu Ala Met Gly Val Pro Ala Glu Thr Ala Gln Trp Ile Ala Phe
 245 250 255

Gly Ile Gln Leu Ala Met Ile Ala Val Thr Ile Ala Ile Gly Phe Ala
 260 265 270

Ser Gly Gly Gly Ala Met Ala Gly Val Ser Lys Ile Ala Asp Met

| | | |
|-------------------------------------------------------------------|-----|-----|
| 275 | 280 | 285 |
| Phe Ser Lys Ser Gln Asp Val Ala Lys Leu Ala Gln Met Ile Glu Lys | | |
| 290 | 295 | 300 |
| Ala Ser Lys Ile Val Gln Ile Ala Gly Ser Val Asn Gln Ser Ala Ile | | |
| 305 | 310 | 315 |
| Gly Gly Thr Gly Ile Gly Thr Ala Val Val Gln Ser Asn Ile Lys Ala | | |
| 325 | 330 | 335 |
| Asn Glu Ser Glu Gln Lys Glu Ile Glu Ala Ala Ile Ala Lys Val Lys | | |
| 340 | 345 | 350 |
| Ala Lys Ile Glu Thr Leu Gln Asp Phe Phe Lys Asn Gln Met Glu Gln | | |
| 355 | 360 | 365 |
| Phe Asn Ala Ile Met Lys Ile Ile Thr Asp Ile Ile Gln Asp Ser Val | | |
| 370 | 375 | 380 |
| Asn Thr Lys Ile Ala Val Gln Arg Gly Ala Arg Glu | | |
| 385 | 390 | 395 |
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| <211> 894 | | |
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| <221> CDS | | |
| <222> (13)..(894) | | |
| <400> 15 | | |
| aggaggaatt at atg tct ctt gtc att aat aac aac ctg atg gcc gtc aat | | |
| Met Ser Leu Val Ile Asn Asn Asn Leu Met Ala Val Asn | | |
| 1 | 5 | 10 |
| gct caa cgt aac tta agc aag tct tat gga gaa ctg agt tct tct gtt | | |
| Ala Gln Arg Asn Leu Ser Tyr Gly Glu Leu Ser Ser Val | | |
| 15 | 20 | 25 |
| 99 | | |
| cga aaa ctt tct tca ggt ctt cgt gta gga act gct gct gat gac tca | | |
| Arg Lys Leu Ser Ser Gly Leu Arg Val Gly Thr Ala Ala Asp Asp Ser | | |
| 30 | 35 | 40 |
| 30 | | |
| 45 | | |
| 147 | | |
| gca ggg tta gcc att cga gaa ctc atg aga tct gac att gca aca aca | | |
| Ala Gly Leu Ala Ile Arg Glu Leu Met Arg Ser Asp Ile Ala Thr Thr | | |
| 50 | 55 | 60 |
| 195 | | |
| caa caa gga ata cga aat gcg aat gat gct att tct atg att caa act | | |
| Gln Gln Gly Ile Arg Asn Ala Asn Asp Ala Ile Ser Met Ile Gln Thr | | |
| 65 | 70 | 75 |
| 243 | | |
| gcg gat ggt gca ctt gga gtc atc gat gaa aag ctc att cga atg aaa | | |
| Ala Asp Gly Ala Leu Gly Val Ile Asp Glu Lys Leu Ile Arg Met Lys | | |
| 80 | 85 | 90 |
| 291 | | |

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| gaa ctt gct gaa caa gct gct aca ggt aca tat aac tcc act cag cgt Glu Leu Ala Glu Gln Ala Ala Thr Gly Thr Tyr Asn Ser Thr Gln Arg 95 100 105 | 339 |
| atg att att gac tct gaa tat caa gct atg gcc tca gaa att act cgt Met Ile Ile Asp Ser Glu Tyr Gln Ala Met Ala Ser Glu Ile Thr Arg 110 115 120 125 | 387 |
| att gct aat gcg aca gaa ttt aat ggt ata aaa ctt ctt gat ggt tca Ile Ala Asn Ala Thr Glu Phe Asn Gly Ile Lys Leu Leu Asp Gly Ser 130 135 140 | 435 |
| tta tca ggt aat cat gat ggg aaa aaa ata aat tca act ggt gca gta Leu Ser Gly Asn His Asp Gly Lys Ile Asn Ser Thr Gly Ala Val 145 150 155 | 483 |
| cgt atc cac ttt ggg aca tct aac agc tct gct gaa gat tac tat gat Arg Ile His Phe Gly Thr Ser Asn Ser Ala Glu Asp Tyr Tyr Asp 160 165 170 | 531 |
| att aaa att ggt ggc tct aca gct tct gca tta gga ctt ggt aat aca Ile Lys Ile Gly Gly Ser Thr Ala Ser Ala Leu Gly Leu Gly Asn Thr 175 180 185 | 579 |
| gta aaa ggt gcg ggt gct aca gtc tct act caa gct gca gca caa aat Val Lys Gly Ala Gly Ala Thr Val Ser Thr Gln Ala Ala Ala Gln Asn 190 195 200 205 | 627 |
| gcc tta aaa gct ata gat aat gcc att gtt tca aaa gat aaa att cga Ala Leu Lys Ala Ile Asp Asn Ala Ile Val Ser Lys Asp Lys Ile Arg 210 215 220 | 675 |
| gca cac ctt ggt gga tta caa aat aga ctt gaa gct aca gtt gat aat Ala His Leu Gly Gly Leu Gln Asn Arg Leu Glu Ala Thr Val Asp Asn 225 230 235 | 723 |
| tta agt ata caa aat gaa aac tta caa gct gct gaa tct cgt ata tct Leu Ser Ile Gln Asn Glu Asn Leu Gln Ala Ala Glu Ser Arg Ile Ser 240 245 250 | 771 |
| gat ata gat gta agc caa gaa atg aca caa ttt gta cgt aac caa ata Asp Ile Asp Val Ser Gln Glu Met Thr Gln Phe Val Arg Asn Gln Ile 255 260 265 | 819 |
| ctt aca caa aca ggt gtt gct atg ctt tca caa gct aat tct cta cca Leu Thr Gln Thr Gly Val Ala Met Leu Ser Gln Ala Asn Ser Leu Pro 270 275 280 285 | 867 |
| cgt atg gct cag caa ctt att ggc taa Arg Met Ala Gln Gln Leu Ile Gly 290 | 894 |
| | |
| <210> 16 | |
| <211> 293 | |
| <212> PRT | |
| <213> Lawsonia intracellularis | |
| | |
| <400> 16 | |
| | |
| Met Ser Leu Val Ile Asn Asn Asn Leu Met Ala Val Asn Ala Gln Arg 1 5 10 15 | |

Asn Leu Ser Lys Ser Tyr Gly Glu Leu Ser Ser Ser Val Arg Lys Leu
 20 25 30

Ser Ser Gly Leu Arg Val Gly Thr Ala Ala Asp Asp Ser Ala Gly Leu
 35 40 45

Ala Ile Arg Glu Leu Met Arg Ser Asp Ile Ala Thr Thr Gln Gln Gly
 50 55 60

Ile Arg Asn Ala Asn Asp Ala Ile Ser Met Ile Gln Thr Ala Asp Gly
 65 70 75 80

Ala Leu Gly Val Ile Asp Glu Lys Leu Ile Arg Met Lys Glu Leu Ala
 85 90 95

Glu Gln Ala Ala Thr Gly Thr Tyr Asn Ser Thr Gln Arg Met Ile Ile
 100 105 110

Asp Ser Glu Tyr Gln Ala Met Ala Ser Glu Ile Thr Arg Ile Ala Asn
 115 120 125

Ala Thr Glu Phe Asn Gly Ile Lys Leu Leu Asp Gly Ser Leu Ser Gly
 130 135 140

Asn His Asp Gly Lys Lys Ile Asn Ser Thr Gly Ala Val Arg Ile His
 145 150 155 160

Phe Gly Thr Ser Asn Ser Ser Ala Glu Asp Tyr Tyr Asp Ile Lys Ile
 165 170 175

Gly Gly Ser Thr Ala Ser Ala Leu Gly Leu Gly Asn Thr Val Lys Gly
 180 185 190

Ala Gly Ala Thr Val Ser Thr Gln Ala Ala Ala Gln Asn Ala Leu Lys
 195 200 205

Ala Ile Asp Asn Ala Ile Val Ser Lys Asp Lys Ile Arg Ala His Leu
 210 215 220

Gly Gly Leu Gln Asn Arg Leu Glu Ala Thr Val Asp Asn Leu Ser Ile
 225 230 235 240

Gln Asn Glu Asn Leu Gln Ala Ala Glu Ser Arg Ile Ser Asp Ile Asp
 245 250 255

Val Ser Gln Glu Met Thr Gln Phe Val Arg Asn Gln Ile Leu Thr Gln
 260 265 270

Thr Gly Val Ala Met Leu Ser Gln Ala Asn Ser Leu Pro Arg Met Ala

275

280

285

Gln Gln Leu Ile Gly
290

<210> 17
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Met Tyr Asn Ile Ile Asn Lys His
1 5

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caa atc ata aaa att tta tta ttt tcc tta tgt gtt ttc ttt ttt aca 100
Gln Ile Ile Lys Ile Leu Leu Phe Ser Leu Cys Val Phe Phe Phe Thr
          10      15      20

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ctt aca gaa aaa caa aaa att tat gct gca gac gtc ttt ttt gag ggc 148
 Leu Thr Glu Lys Gln Lys Ile Tyr Ala Ala Asp Val Phe Phe Glu Gly
 25 30 35 40

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aga acc gaa acc tta atc aat gta aac aaa cca ttt gat tct ttt ttt 196
Arg Thr Glu Thr Leu Ile Asn Val Asn Lys Pro Phe Asp Ser Phe Phe
        45          50          55

```

gga ggt tct gac tct aca ata gga acc ctt gaa aca gga cct act aat 244
Gly Gly Ser Asp Ser Thr Ile Gly Thr Leu Glu Thr Gly Pro Thr Asn
60 65 70

ctt acc ttc aca aca gta gga gcc ttc cgc aat tct gtt ttc aga att 292
 Leu Thr Phe Thr Thr Val Gly Ala Phe Arg Asn Ser Val Phe Arg Ile
 75 80 85

att ggt ggt ggt agg tct agt ttt aac aac cca aat aca gtt aaa ggc 340
 Ile Gly Gly Gly Arg Ser Ser Phe Asn Asn Pro Asn Thr Val Lys Gly
 90 95 100

```

aat gtt act cta act gtt tat aat act gat gta gaa aga ata att ggt      388
Asn Val Thr Leu Thr Val Tyr Asn Thr Asp Val Glu Arg Ile Ile Gly
105          110          115          120

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gca ggt atc agc aat aga gga ctt gta acc gtt act ggc tca gta aat 436
Ala Gly Ile Ser Asn Arg Gly Leu Val Thr Val Thr Gly Ser Val Asn
          125           130           135

```

atg aag cta gaa aat gtt tct gtt act aga gga att tat ggt ggt gtc 484
 Met Lys Leu Glu Asn Val Ser Val Thr Arg Gly Ile Tyr Gly Gly Val
 140 145 150

tat actcaaataatggacatgtactatggctctatcAACatTTGaaa
Tyr Thr Gln Asn Gly His Val Leu Gly Ser Ile Asn Met His Leu Lys
155 160 165

```

aac gtc caa act cca cta tta ata ggt tct gga gta agc aat gga cct      580
Asn Val Gln Thr Pro Leu Leu Ile Gly Ser Gly Val Ser Asn Gly Pro
    170          175          180

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| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| aat cgt att act gta aat gga gac ata aac att gat gtt gaa gac tct Asn Arg Ile Thr Val Asn Gly Asp Ile Asn Ile Asp Val Glu Asp Ser 185 190 195 200 | 628 |
| agg att caa tat gta aac att aca gga gaa gta gat gca ggg ata aaa Arg Ile Gln Tyr Val Asn Ile Thr Gly Glu Val Asp Ala Gly Ile Lys 205 210 215 | 676 |
| gga aat gct act cta act gta aaa aaa tct act gtt gag ctt ata aac Gly Asn Ala Thr Leu Thr Val Lys Lys Ser Thr Val Glu Leu Ile Asn 220 225 230 | 724 |
| tct ggt aga ggt aat atc tta ggt aat ctc aaa ata tct ata gca gat Ser Gly Arg Gly Asn Ile Leu Gly Asn Leu Lys Ile Ser Ile Ala Asp 235 240 245 | 772 |
| tca aat ata agg ggg tta tca cca gta gac ttt ggt tct tca gta tat Ser Asn Ile Arg Gly Leu Ser Pro Val Asp Phe Gly Ser Ser Val Tyr 250 255 260 | 820 |
| ggg gac aca tct ata aat gta att aat tct cag att aat gat att act Gly Asp Thr Ser Ile Asn Val Ile Asn Ser Gln Ile Asn Asp Ile Thr 265 270 275 280 | 868 |
| ctt ata cca agg gct ggt gga atg ctt gta ggt cct gtt acc cta gat Leu Ile Pro Arg Ala Gly Met Leu Val Gly Pro Val Thr Leu Asp 285 290 295 | 916 |
| atc aca agc agt act ata caa aat ata caa tgt ggg cct gtc agt caa Ile Thr Ser Thr Ile Gln Asn Ile Gln Cys Gly Pro Val Ser Gln 300 305 310 | 964 |
| aat aat caa ctt aac aca cta aat gta act gtt aat act agt aac att Asn Asn Gln Leu Asn Thr Leu Asn Val Thr Val Asn Thr Ser Asn Ile 315 320 325 | 1012 |
| act aac tta aac ctt ggt agt gtc gaa ggt cat aca ata tca act aca Thr Asn Leu Asn Leu Gly Ser Val Glu Gly His Thr Ile Ser Thr Thr 330 335 340 | 1060 |
| gca act gtt act gat agt aat att act aac ctt aat gtc gga acc ttc Ala Thr Val Thr Asp Ser Asn Ile Thr Asn Leu Asn Val Gly Thr Phe 345 350 355 360 | 1108 |
| aat gga ctt gga gta act gag aat gcc tct gta atc att aat agt ggc Asn Gly Leu Gly Val Thr Glu Asn Ala Ser Val Ile Ile Asn Ser Gly 365 370 375 | 1156 |
| aat att act aac ctt aat gtc gga act aat gta ata gct gca gcc aca Asn Ile Thr Asn Leu Asn Val Gly Thr Asn Val Ile Ala Ala Thr 380 385 390 | 1204 |
| act att aat tcc tct gcg acc ata cac gac gga ctt att gca aac ctt Thr Ile Asn Ser Ser Ala Thr Ile His Asp Gly Leu Ile Ala Asn Leu 395 400 405 | 1252 |
| acc tta ggc tca caa ggt aat ggt cgt act atg ata gct aca gca aat Thr Leu Gly Ser Gln Gly Asn Gly Arg Thr Met Ile Ala Thr Ala Asn 410 415 420 | 1300 |
| gtt aat ggt gga act att gga tta tta act atg ggt tca gaa aac ttc Val Asn Gly Gly Thr Ile Gly Leu Leu Thr Met Gly Ser Glu Asn Phe 425 430 435 440 | 1348 |

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| ata cca ggc aca aga cca att act gaa tta gca ata cta aac atg tct Ile Pro Gly Thr Arg Pro Ile Thr Glu Leu Ala Ile Leu Asn Met Ser 445 450 455 | 1396 |
| ggt gga tta att gaa aga att atc gta ggt aat gcc aac tct tca acc Gly Gly Leu Ile Glu Arg Ile Ile Val Gly Asn Ala Asn Ser Ser Thr 460 465 470 | 1444 |
| ata aac ttt act cct ggg aag aga tca att gta aaa aca ata aat ggt Ile Asn Phe Thr Pro Gly Lys Arg Ser Ile Val Lys Thr Ile Asn Gly 475 480 485 | 1492 |
| cca gaa ctt cca tat tta gtt aac ata caa aaa ggt gct atg aca caa Pro Glu Leu Pro Tyr Leu Val Asn Ile Gln Lys Gly Ala Met Thr Gln 490 495 500 | 1540 |
| tgg ggc act aaa aat atg ccc ttt tta ttg gat aca aga aat tta atc Trp Gly Thr Lys Asn Met Pro Phe Leu Leu Asp Thr Arg Asn Leu Ile 505 510 515 520 | 1588 |
| ttg tcc gga act ctg att acc tca aat att caa cta gct gat tta tct Leu Ser Gly Thr Leu Ile Thr Ser Asn Ile Gln Leu Ala Asp Leu Ser 525 530 535 | 1636 |
| ata acc aat cta ttt gtt gct aat ggc ggt aca cta gta cct aga aaa Ile Thr Asn Leu Phe Val Ala Asn Gly Gly Thr Leu Val Pro Arg Lys 540 545 550 | 1684 |
| tta ata cct ggg aac caa cct gtt ata cag ttt ctt gga ggt cct caa Leu Ile Pro Gly Asn Gln Pro Val Ile Gln Phe Leu Gly Gly Pro Gln 555 560 565 | 1732 |
| tca ctc tta gtt atc cat caa cca tta aaa gta aat tta agc tta tca Ser Leu Leu Val Ile His Gln Pro Leu Lys Val Asn Leu Ser Leu Ser 570 575 580 | 1780 |
| cca aaa ctt att gga agt agc atg gtg cca ctt gct ttt gtc tct caa Pro Lys Leu Ile Gly Ser Ser Met Val Pro Leu Ala Phe Val Ser Gln 585 590 595 600 | 1828 |
| tct ttt tca tca cca gat ctt ttt gtt aaa caa act aga agt ggt ctc Ser Phe Ser Ser Pro Asp Leu Phe Val Lys Gln Thr Arg Ser Gly Leu 605 610 615 | 1876 |
| att tgg agt gat ctt gag ttt gat cca aca aca tct att tgg tat gtt Ile Trp Ser Asp Leu Glu Phe Asp Pro Thr Thr Ser Ile Trp Tyr Val 620 625 630 | 1924 |
| aat aat atc caa gca tct caa gat ttt tac tct ttc tct att gct cgt Asn Asn Ile Gln Ala Ser Gln Asp Phe Tyr Ser Phe Ser Ile Ala Arg 635 640 645 | 1972 |
| gag act act aac tgg cta aga caa caa cat ata tgg act cta caa aac Glu Thr Thr Asn Trp Leu Arg Gln Gln His Ile Trp Thr Leu Gln Asn 650 655 660 | 2020 |
| cgt tca agt aaa ctt tta gac aac gaa cat tat gga cta tgg ata aat Arg Ser Ser Lys Leu Leu Asp Asn Glu His Tyr Gly Leu Trp Ile Asn 665 670 675 680 | 2068 |
| gtt caa ggt gga cat gaa agt ctt gat act tct att ggt agc aaa gca Val Gln Gly Gly His Glu Ser Leu Asp Thr Ser Ile Gly Ser Lys Ala 685 690 695 | 2116 |
| aaa atg cca tgg ata atg gca aca gca gga tat gac tat ctt caa caa | 2164 |

| | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Lys Met Pro Trp Ile Met Ala Thr Ala Gly Tyr Asp Tyr Leu Gln Gln 700 705 710 | |
| ctc cca agg tta gat atg aaa gcc ctt tat ggt ctt gct ttt ggt gct Leu Pro Arg Leu Asp Met Lys Ala Leu Tyr Gly Leu Ala Phe Gly Ala 715 720 725 | 2212 |
| tct aaa ggt aaa agt aaa tgg tct agc gtc aac tct aca aaa aat gat Ser Lys Gly Lys Ser Lys Trp Ser Ser Val Asn Ser Thr Lys Asn Asp 730 735 740 | 2260 |
| gct gag cta ggt atg gtt agt ggt tat gta ggt ctt atc cat aac aaa Ala Glu Leu Gly Met Val Ser Gly Tyr Val Gly Leu Ile His Asn Lys 745 750 755 760 | 2308 |
| act ggg ctc tat agt aca ttg acc tta caa ctt gcg tct agt aaa tta Thr Gly Leu Tyr Ser Thr Leu Thr Leu Gln Leu Ala Ser Ser Lys Leu 765 770 775 | 2356 |
| cat act aat tct aca ggg ttc tat aga aat ttt aaa tgg aca gaa aca His Thr Asn Ser Thr Gly Phe Tyr Arg Asn Phe Lys Trp Thr Glu Thr 780 785 790 | 2404 |
| act cca aca gaa gca ctt gaa ctt gga tgg aaa tac act ttc aac aac Thr Pro Thr Glu Ala Leu Glu Leu Gly Trp Lys Tyr Thr Phe Asn Asn 795 800 805 | 2452 |
| ggt att aaa atg aat cct cgt gga caa ctt att ttt gaa caa aca tct Gly Ile Lys Met Asn Pro Arg Gly Gln Leu Ile Phe Glu Gln Thr Ser 810 815 820 | 2500 |
| aaa cac cat ttt gat tta gga att caa aat gat aag gct ata tta gat Lys His His Phe Asp Ieu Gly Ile Gln Asn Asp Lys Ala Ile Leu Asp 825 830 835 840 | 2548 |
| aaa agc cag tta ata aca agt tct ctt ggt att acc gtt gaa tat aag Lys Ser Gln Leu Ile Thr Ser Ser Leu Gly Ile Thr Val Glu Tyr Lys 845 850 855 | 2596 |
| cta cca gtt acc aca cct att aat ctt tat gct ggt att gaa agg ata Leu Pro Val Thr Thr Pro Ile Asn Leu Tyr Ala Gly Ile Glu Arg Ile 860 865 870 | 2644 |
| aaa ggt cag tct gga aac ttt gca att agt tcc cag agc ctt caa atg Lys Gly Gln Ser Gly Asn Phe Ala Ile Ser Ser Gln Ser Leu Gln Met 875 880 885 | 2692 |
| aag ttc aag cat gac aat gat aca agt gta gtt aga gca aca ata ggt Lys Phe Lys His Asp Asn Asp Thr Ser Val Val Arg Ala Thr Ile Gly 890 895 900 | 2740 |
| aca aat ata tta ttg gga gaa cat ttt aat att cac tgt gat ata ttt Thr Asn Ile Leu Leu Gly Glu His Phe Asn Ile His Cys Asp Ile Phe 905 910 915 920 | 2788 |
| gga gat aaa gga aat gat aaa ggc att ggt ggg caa gca gga ttt aca Gly Asp Lys Gly Asn Asp Lys Gly Ile Gly Gly Gln Ala Gly Phe Thr 925 930 935 | 2836 |
| tac aaa ttt taa Tyr Lys Phe | 2848 |

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<400> 18

Met Tyr Asn Ile Ile Asn Lys His Gln Ile Ile Lys Ile Leu Leu Phe
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Ala Ala Asp Val Phe Phe Glu Gly Arg Thr Glu Thr Leu Ile Asn Val
35 40 45

Asn Lys Pro Phe Asp Ser Phe Phe Gly Gly Ser Asp Ser Thr Ile Gly
50 55 60

Thr Leu Glu Thr Gly Pro Thr Asn Leu Thr Phe Thr Thr Val Gly Ala
65 70 75 80

Phe Arg Asn Ser Val Phe Arg Ile Ile Gly Gly Arg Ser Ser Phe
85 90 95

Asn Asn Pro Asn Thr Val Lys Gly Asn Val Thr Leu Thr Val Tyr Asn
100 105 110

Thr Asp Val Glu Arg Ile Ile Gly Ala Gly Ile Ser Asn Arg Gly Leu
115 120 125

Val Thr Val Thr Gly Ser Val Asn Met Lys Leu Glu Asn Val Ser Val
130 135 140

Thr Arg Gly Ile Tyr Gly Val Tyr Thr Gln Asn Gly His Val Leu
145 150 155 160

Gly Ser Ile Asn Met His Leu Lys Asn Val Gln Thr Pro Leu Leu Ile
165 170 175

Gly Ser Gly Val Ser Asn Gly Pro Asn Arg Ile Thr Val Asn Gly Asp
180 185 190

Ile Asn Ile Asp Val Glu Asp Ser Arg Ile Gln Tyr Val Asn Ile Thr
195 200 205

Gly Glu Val Asp Ala Gly Ile Lys Gly Asn Ala Thr Leu Thr Val Lys
210 215 220

Lys Ser Thr Val Glu Leu Ile Asn Ser Gly Arg Gly Asn Ile Leu Gly
225 230 235 240

Asn Leu Lys Ile Ser Ile Ala Asp Ser Asn Ile Arg Gly Leu Ser Pro
 245 250 255

 Val Asp Phe Gly Ser Ser Val Tyr Gly Asp Thr Ser Ile Asn Val Ile
 260 265 270

 Asn Ser Gln Ile Asn Asp Ile Thr Leu Ile Pro Arg Ala Gly Gly Met
 275 280 285

 Leu Val Gly Pro Val Thr Leu Asp Ile Thr Ser Ser Thr Ile Gln Asn
 290 295 300

 Ile Gln Cys Gly Pro Val Ser Gln Asn Asn Gln Leu Asn Thr Leu Asn
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 Val Thr Val Asn Thr Ser Asn Ile Thr Asn Leu Asn Leu Gly Ser Val
 325 330 335

 Glu Gly His Thr Ile Ser Thr Thr Ala Thr Val Thr Asp Ser Asn Ile
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 Thr Asn Leu Asn Val Gly Thr Phe Asn Gly Leu Gly Val Thr Glu Asn
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 Ala Ser Val Ile Ile Asn Ser Gly Asn Ile Thr Asn Leu Asn Val Gly
 370 375 380

 Thr Asn Val Ile Ala Ala Ala Thr Thr Ile Asn Ser Ser Ala Thr Ile
 385 390 395 400

 His Asp Gly Leu Ile Ala Asn Leu Thr Leu Gly Ser Gln Gly Asn Gly
 405 410 415

 Arg Thr Met Ile Ala Thr Ala Asn Val Asn Gly Gly Thr Ile Gly Leu
 420 425 430

 Leu Thr Met Gly Ser Glu Asn Phe Ile Pro Gly Thr Arg Pro Ile Thr
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 Glu Leu Ala Ile Leu Asn Met Ser Gly Gly Leu Ile Glu Arg Ile Ile
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 Val Gly Asn Ala Asn Ser Ser Thr Ile Asn Phe Thr Pro Gly Lys Arg
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 Ser Ile Val Lys Thr Ile Asn Gly Pro Glu Leu Pro Tyr Leu Val Asn
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Ile Gln Lys Gly Ala Met Thr Gln Trp Gly Thr Lys Asn Met Pro Phe
 500 505 510

Leu Leu Asp Thr Arg Asn Leu Ile Leu Ser Gly Thr Leu Ile Thr Ser
 515 520 525

Asn Ile Gln Leu Ala Asp Leu Ser Ile Thr Asn Leu Phe Val Ala Asn
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Gly Gly Thr Leu Val Pro Arg Lys Leu Ile Pro Gly Asn Gln Pro Val
 545 550 555 560

Ile Gln Phe Leu Gly Gly Pro Gln Ser Leu Leu Val Ile His Gln Pro
 565 570 575

Leu Lys Val Asn Leu Ser Leu Ser Pro Lys Leu Ile Gly Ser Ser Met
 580 585 590

Val Pro Leu Ala Phe Val Ser Gln Ser Phe Ser Ser Pro Asp Leu Phe
 595 600 605

Val Lys Gln Thr Arg Ser Gly Leu Ile Trp Ser Asp Leu Glu Phe Asp
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Pro Thr Thr Ser Ile Trp Tyr Val Asn Asn Ile Gln Ala Ser Gln Asp
 625 630 635 640

Phe Tyr Ser Phe Ser Ile Ala Arg Glu Thr Thr Asn Trp Leu Arg Gln
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Gln His Ile Trp Thr Leu Gln Asn Arg Ser Ser Lys Leu Leu Asp Asn
 660 665 670

Glu His Tyr Gly Leu Trp Ile Asn Val Gln Gly Gly His Glu Ser Leu
 675 680 685

Asp Thr Ser Ile Gly Ser Lys Ala Lys Met Pro Trp Ile Met Ala Thr
 690 695 700

Ala Gly Tyr Asp Tyr Leu Gln Gln Leu Pro Arg Leu Asp Met Lys Ala
 705 710 715 720

Leu Tyr Gly Leu Ala Phe Gly Ala Ser Lys Gly Lys Ser Lys Trp Ser
 725 730 735

Ser Val Asn Ser Thr Lys Asn Asp Ala Glu Leu Gly Met Val Ser Gly
 740 745 750

Tyr Val Gly Leu Ile His Asn Lys Thr Gly Leu Tyr Ser Thr Leu Thr

| | | |
|-----------------------------------------------------------------|-----|-----|
| 755 | 760 | 765 |
| Leu Gln Leu Ala Ser Ser Lys Leu His Thr Asn Ser Thr Gly Phe Tyr | | |
| 770 | 775 | 780 |
| Arg Asn Phe Lys Trp Thr Glu Thr Thr Pro Thr Glu Ala Leu Glu Leu | | |
| 785 | 790 | 795 |
| Gly Trp Lys Tyr Thr Phe Asn Asn Gly Ile Lys Met Asn Pro Arg Gly | | |
| 805 | 810 | 815 |
| Gln Leu Ile Phe Glu Gln Thr Ser Lys His His Phe Asp Leu Gly Ile | | |
| 820 | 825 | 830 |
| Gln Asn Asp Lys Ala Ile Leu Asp Lys Ser Gln Leu Ile Thr Ser Ser | | |
| 835 | 840 | 845 |
| Leu Gly Ile Thr Val Glu Tyr Lys Leu Pro Val Thr Thr Pro Ile Asn | | |
| 850 | 855 | 860 |
| Leu Tyr Ala Gly Ile Glu Arg Ile Lys Gly Gln Ser Gly Asn Phe Ala | | |
| 865 | 870 | 875 |
| Ile Ser Ser Gln Ser Leu Gln Met Lys Phe Lys His Asp Asn Asp Thr | | |
| 885 | 890 | 895 |
| Ser Val Val Arg Ala Thr Ile Gly Thr Asn Ile Leu Leu Gly Glu His | | |
| 900 | 905 | 910 |
| Phe Asn Ile His Cys Asp Ile Phe Gly Asp Lys Gly Asn Asp Lys Gly | | |
| 915 | 920 | 925 |
| Ile Gly Gly Gln Ala Gly Phe Thr Tyr Lys Phe | | |
| 930 | 935 | |